CLAIMS:

1. A method of manufacturing an optical component having at least one photo-oriented polymeric layer provided on a substrate, wherein the method includes the steps of:

providing a single source of laser radiation;

splitting the laser radiation into a first beam of linearly polarised light having a first plane of polarisation, and a second beam of linearly polarised light having a second plane of polarisation;

directing the first beam of linearly polarised light onto a first area or areas of at least one photo-orientatable polymeric layer to cause a first molecular orientation in the first area or areas of the layer; and

directing the second beam of linearly polarised light onto said photo-orientatable polymeric layer to cause a second molecular orientation in a second area or areas of the layer.

2. A method according to claim 1 wherein the arrangement is such that the second beam of linearly polarised light arrives at the photo-orientatable polymeric layer a predetermined delay time after the first beam of linearly polarised light.

3. A method according to claim 2 wherein the predetermined delay time is sufficient for the first beam to have caused the first molecular orientation in the first area or areas of the photo-orientatable polymeric layer before the second beam arrives.

4. A method according to claim 2 or claim 3 wherein the predetermined delay time is in the order of nanoseconds.

5. A method according to any one of claims 2 to 4 wherein the predetermined time delay is approximately 20 nanoseconds.

6. A method according to any one of the preceding claims wherein the first beam is directed onto the first area or areas of the photo-orientable polymeric layer through a mask.

7. A method according to claim 6 wherein the second beam is directed onto the second area or areas of the photo-orientable polymeric layer through a mask.

8. A method according to any one of claims 1 to 6 wherein the second beam is directed onto the entire area of the photo-orientatable polymeric layer including the first and second areas.

9. A method according to any one of the preceding claims wherein the energy of each of the first and second beams is less than the energy required to cause laser ablation of the photo-orientatable polymeric layer.

10. A method according to any one of the preceding claims wherein the ratio of the energy of the first beam to the energy of the second beam is approximately 2:1 energy units.

11. A method according to any one of claims 1 to 10 wherein the photo-oriented polymeric layer is a photo-oriented polymer network (PPN).

12. A method according to any one of claims 1 to 11 further including the step of applying at least one liquid crystal polymer (LCP) layer to the photo-oriented polymeric layer.

13. A method according to claim 12 wherein the LCP layer is applied such that its molecules have an orientation determined by the orientation of the underlying photo-oriented polymeric layer, or transferred therefrom to the LCP layer.

14. A method according to any one of claims 12 or claim 13 wherein the LCP layer is photo-cross-linked by the action of light of a suitable wavelength and retains the orientation of molecules determined by the photo-oriented polymeric layer.

15. A method according to claim 14 wherein the photo-cross-linking fixes the orientation of a first area of the LCP layer the same as the orientation of the first area of the photo-oriented polymeric layer.

16. A method according to either claim 14 or claim 15 wherein the photo-cross-linking fixes the orientation of a second area of the LCP layer the same as the orientation of the second area of the photo-oriented polymeric layer.

17. A method according to any one of claims 11 to 16 wherein the LCP layer comprises an isotropic layer of orientated cross-linked liquid crystal monomers.

18. A method according to any one of claims 11 to 16 wherein the photo-orientated polymer network is applied to an orientating layer.

19. A method according to any one of claims 12 to 18 wherein further orientating layers and/or LCP layers are applied to the optical element.

20. A method according to any one of claims 11 to 19 wherein the optical element includes two or more photo-orientatable layers and LCP layers having different orientation patterns provided to form a stack of photo-orientable layers and LCP layers on a substrate.

21. A method according to any one of claims 1 to 20 wherein a reflector layer is applied between the photo-orientatable polymeric layer and the substrate.

22. A method according to any one of claims 1 to 20 wherein the optical element further includes a polarising layer.

23. A method according to claim 22 wherein the polarising layer is a linear polariser.

24. A method according to claim 22 or claim 23 wherein the polarising layer is applied between the orientation layer and the substrate.

25. A method according to any one of claims 11 to 24 wherein a primer layer is applied between the substrate and the PPN layer to improve adhesion of the PPN layer to the substrate.

26. A method according to any one of the preceding claims wherein the energy of each of the first and second beams is less than the cohesive/adhesive forces adhering the photo-orientatable layer to the substrate.

27. An apparatus for manufacturing an optical component having at least one photo-oriented polymeric layer, wherein the apparatus comprises:

a single source of laser radiation;

beam splitting means for splitting the laser radiation into a first beam of linearly polarised light having a first plane of polarisation and a second beam of linearly polarised light having a second plane of polarisation;

first directing means for directing the first beam of linearly polarised light onto a first area or areas of at least one photo-orientatable polymeric layer to cause a first molecular orientation in said first area or areas of the layer; and

second directing means for directing the second beam of linearly polarised light onto said at least one photo-orientatable polymeric layer to cause a second molecular orientation in a second area or areas of the layer;

wherein the apparatus includes delay means for the second beam of linearly polarised light so that the second beam arrives at the photo-orientatable layer a predetermined delay time after the first beam of linearly polarised light.

28. An apparatus according to claim 27 wherein the second beam of linearly polarised light is reflected off a plurality of mirrors before it is directed onto the photo-orientatable polymeric layer.

29. An apparatus according to claim 27 or claim 28 wherein the first beam of linearly polarised light is directed onto the photo-orientatable layer through a mask so that only the first area or areas of the photo-orientatable polymeric layer are exposed to the first beam.

30. An apparatus according to any one of claims 27 to 29 wherein the second beam of linearly polarised light is directed onto the second area or areas through a mask.

31. An apparatus according to claim 29 or claim 30 wherein the mask is formed from any one of the following:

chrome; or

quartz; or

a dielectric material.

32. An apparatus according to any one of claims 27 to 29 wherein the second beam is directed onto the entire area of the photo-orientatable polymeric layer including the first and second areas.

33. An apparatus according to any one of claims 27 to 29 further including a second beam splitting means for splitting the second beam into a third beam having a third plane of polarization.

34. An apparatus according to claim 33 further including third directing means for directing the third beam of linearly polarised light onto said photo-orientatable polymeric layer to cause a third molecular orientation in a third area or areas.

35. An apparatus according to any one of claims 27 to 34 further including at least one polarization rotator.

36. An apparatus according to any one of claims 27 to 35 further including an attenuator to provide energy control for the second beam.

37. An apparatus according to any one of claims 27 to 36 further including a diode laser, a cylindrical lens and an adjustment mirror for aligning the direction of the second beam.

38. An optical component which incorporates at least one photo-oriented polymeric layer formed by the method of any one of claims 1 to 26.

39. An optical component which incorporates at least one photo-oriented polymeric layer formed by the apparatus of any one of claims 27 to 37.

40. A security document or device including an optical component formed by the method of any one of claims 1 to 26.

41. A security document or device including an optical component formed by the apparatus of any one of claims 27 to 37.